#3196

WATER QUALITY MEMORANDUM

Utah Coal Regulatory Program

May 11, 2009

TO: Internal File

THRU: Daron Haddock, Permit Supervisor

FROM: Dana Dean, P.E., Senior Reclamation Hydrologist

RE: 2007 Fourth Quarter Water Monitoring, Canyon Fuel Company, LLC, Skyline Mine, C/007/0005, WQ07-4, Task ID #3196

The Skyline Mine is an operating longwall mine. Current operations are in the North Lease area of the mine. Many mined-out areas of the mine have been sealed-off. Water monitoring requirements can be found in Section 2, especially pages 2-36, 2-36a, 2-36b, 2-37, 2-37a, and 2-39aa of the MRP.

There are 42 stream sampling sites in the North Lease where the Permittee will measure flow on a monthly basis for 12 months prior to, during and 12 months after longwall mining below each site. The Division will check this monitoring in conjunction with the Annual Report.

1. Was data submitted for all of the MRP required sites? YES ☒ NO ☐

Springs

The MRP requires third quarter sampling at 25 springs.

The Permittee submitted all required samples for the spring sites.

Streams

The MRP requires third quarter sampling of 35 stream sites.

The Permittee submitted all required samples for the stream sites.

Wells

The MRP requires third quarter monitoring at 18 wells.

The Permittee submitted the required well site samples.

UPDES

The UPDES Permit/MRP require ***weekly*** *monitoring of 3 outfalls: 001, Sedimentation Pond Discharge to Eccles Creek at the Portal; 002, Sedimentation Pond Discharge to Eccles Creek at the Loadout; and 003, the Sedimentation Discharge at the Waste Rock Disposal Site. Well JC-3 is permitted as a UPDES point, but PacifiCorp is the Permittee, and JC-3 has not discharged since July of 2004.*

The Permittee submitted all required samples for the UPDES sites. Only outfall 001 reported flow.

2. Were all required parameters reported for each site? YES ☐ NO ☒

Tritium was not reported at EL-1, EL-2, S15-3, S24-1, 2-413, JC-1, JC-3 or 8-253. The laboratory that provides the age dating data quite often takes a long time to report the data back to the Permittee. The Permittee has always been quite prompt at getting the data to the Division as soon as they receive it from the lab.

3. Were any irregularities found in the data? YES ☒ NO ☐

Some parameters fell outside of two standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard Deviations from Mean	Mean
CS-3	Total Dissolved Solids	419 mg/L	2.67	272.4 mg/L
CS-3	Chloride	73 mg/L	3.55	14.61 mg/L
CS-3	Nitrate + Nitrite	3.18 mg/L	5.73	0.53 mg/L
CS-3	Dissolved Calcium	99.32 mg/L	2.10	75.49 mg/L
CS-3	Total Hardness	333 mg/L	2.10	270.5 mg/L
CS-4	Nitrate + Nitrite	5.58 mg/L	12.93	0.15 mg/L
CS-4	Cation/Anion Balance	4.1%	2.89	1.46%
CS-6	Nitrate + Nitrite	3.59 mg/L	4.43	0.41 mg/L
CS-9	Nitrate + Nitrite	4.09 mg/L	4.94	1.12 mg/L
CS-11	Nitrate + Nitrite	4.96 mg/L	10.95	0.14 mg/L
CS-12 (Nov. 16)	Nitrate + Nitrite	2.39 mg/L	2.70	0.42 mg/L
CS-12 (Dec. 22)	Bicarbonate as $CaCO_3$	270 mg/L	2.65	446.3 mg/L
CS-12 (Dec. 22)	Nitrate + Nitrite	2.39 mg/L	2.70	0.42 mg/L
CS-13	Nitrate + Nitrite	3.39 mg/L	8.03	0.27 mg/L
CS-16	Specific Conductivity	219 µmhos/cm	2.74	315.08 µmhos/cm

CS-19	Total Dissolved Solids	308 mg/L	2.29	263.93 mg/L
CS-20	Total Dissolved Solids	291 mg/L	2.07	223.18 mg/L
CS-21	Total Dissolved Solids	335 mg/L	3.14	260.88 mg/L
F-10 (Nov. 1)	Total Dissolved Solids	335 mg/L	3.14	260.88 mg/L
UPL-10	Nitrate + Nitrite	0.82 mg/L	7.40	0.17 mg/L
VC-6	Nitrate + Nitrite	2.44 mg/L	2.63	0.62 mg/L
VC-9	Nitrate + Nitrite	3.61 mg/L	4.81	0.43 mg/L
S17-2	Nitrate + Nitrite	3.88 mg/L	4.61	0.46 mg/L
3-290	Water Temperature	0.2 °C	3.29	9.26 °C
WQ3-6	Water Temperature	10.4 °C	2.39	7.58 °C
WQ3-6	Total Suspended Solids	109 mg/L	4.35	19 mg/L
WQ3-6	Chloride	5 mg/L	2.01	3.92 mg/L
WQ3-26	Water Temperature	11 °C	2.63	7.03 °C
WQ3-41	Total Suspended Solids	730 mg/L	8.05	86.5 mg/L
WQ4-12	Water Temperature	10.8 °C	2.14	7.40 °C

Bicarbonate has only been measured as $CaCO_3$ for 12 of 108 samples. The samples indicate that the total alkalinity is the same as the bicarbonate, and this value is not outside of the normal range of alkalinity over the years.

The cation/anion balance at CS-4 is not of concern, since it is within the expected range (<5%) at each site.

There is a weak upward trend in chloride at WQ3-6 ($R^2 = 0.3996$). There are only 18 samples in the population, twelve of which are 4 mg/L, one is 3 mg/L, and five are 5mg/L. This level is well below any water quality standards, and is not of concern. There is a fairly strong upward trend in chloride at CS-3 ($R^2 = 0.6999$), but levels are well below the drinking water criterion of 250 mg/L, and the criteria for protection of aquatic life of 600 mg/L.

There is no trend in dissolved calcium at CS-3. Total hardness has mostly been "hard" (150-300 mg/L). In the fourth quarter of 2005, and 2006 the hardness crossed over to "very hard" (>300mg/L), but otherwise has not changed much.

The nitrate+nitrite is well below the recommended limit of 10 mg/L at all of the listed sites, and therefore not of concern.

There is a weak downward trend in the specific conductivity at CS-16, this follows the trend in TDS. Fewer dissolved solids is actually an improvement in water quality.

There is a no trend in the TDS at any of the listed sites, and the levels remain well below the secondary drinking water standard of 500 mg/L.

There is no trend in the total suspended solids at WQ3-6 or WQ3-41. The level at WQ3-41 is extremely high, but is not of concern unless levels stay high. Samples at springs are vulnerable to skewed TSS readings, especially if the flow is low, as it was this quarter.

Several routine Reliability Checks were outside of standard values. They were:

Site	Reliability Check	Value Should Be...	Value is...
CS-3	Conductivity/Cations	>90 & < 110	80
CS-3	Na/(Na + Cl)	> 50%	22%
CS-4	Conductivity/Cations	>90 & < 110	81
CS-6	Conductivity/Cations	>90 & < 110	88
CS-6	Mg/(Ca + Mg)	< 40 %	52%
CS-6	Ca/ (Ca + SO4)	> 50 %	49%
CS-9	TDS/Conductivity	>0.55 & <0.75	0.77
CS-9	Conductivity/Cations	>90 & < 110	71
CS-11	Na/(Na + Cl)	> 50%	46%
CS-12 (Nov. 16)	TDS/Conductivity	>0.55 & <0.75	0.89
CS-12 (Nov. 16)	Conductivity/Cations	>90 & < 110	68
CS-12 (Nov. 16)	Mg/(Ca + Mg)	< 40 %	53%
CS-12 (Nov. 16)	Ca/ (Ca + SO4)	> 50 %	35%
CS-12 (Dec. 22)	Mg/(Ca + Mg)	< 40 %	47%
CS-13	Conductivity/Cations	>90 & < 110	86
CS-13	Na/(Na + Cl)	> 50%	45%
CS-14 (Nov. 16)	TDS/Conductivity	>0.55 & <0.75	0.82
CS-14 (Nov. 16)	Conductivity/Cations	>90 & < 110	68
CS-14 (Nov. 16)	Mg/(Ca + Mg)	< 40 %	46%
CS-14 (Dec. 22)	Mg/(Ca + Mg)	< 40 %	47%
CS-19	Conductivity/Cations	>90 & < 110	75
CS-19	TDS/Conductivity	>0.55 & <0.75	0.79
CS-20	Conductivity/Cations	>90 & < 110	68
CS-20	TDS/Conductivity	>0.55 & <0.75	0.94
CS-20	K/(Na + K)	< 20%	22%
CS-21	Conductivity/Cations	>90 & < 110	74
CS-21	TDS/Conductivity	>0.55 & <0.75	0.86
F-10 Sep 21	Conductivity/Cations	>90 & < 110	76
F-10 Sep 21	K/(Na + K)	< 20%	21%
UPL-10	TDS/Conductivity	>0.55 & <0.75	0.96
UPL-10	Conductivity/Cations	>90 & < 110	65

UPL-10	Na/(Na + Cl)	> 50%	38%
VC-6	Mg/(Ca + Mg)	< 40 %	47%
VC-9	Conductivity/Cations	>90 & < 110	89
VC-9	Mg/(Ca + Mg)	< 40 %	52%
VC-9	Ca/ (Ca + SO4)	> 50 %	47%
S13-7	Conductivity/Cations	>90 & < 110	77
S13-7	K/(Na + K)	< 20%	24%
S17-2	Conductivity/Cations	>90 & < 110	88
S17-2	Mg/(Ca + Mg)	< 40 %	41%
S17-2	Na/(Na + Cl)	> 50%	43%
WQ1-39	Conductivity/Cations	>90 & < 110	73
WQ1-39	K/(Na + K)	< 20%	20%
WQ3-6	Conductivity/Cations	>90 & < 110	71
WQ3-26	TDS/Conductivity	>0.55 & <0.75	0.48
WQ3-26	Conductivity/Cations	>90 & < 110	115
WQ3-26	K/(Na + K)	< 20%	29%
WQ3-41	Conductivity/Cations	>90 & < 110	72
WQ3-43	Conductivity/Cations	>90 & < 110	75
WQ4-12	Conductivity/Cations	>90 & < 110	73
WQ4-12	K/(Na + K)	< 20%	25%
92-91-03	Conductivity/Cations	>90 & < 110	82
92-91-03	K/(Na + K)	< 20%	21%
UT0023540-001 (Oct. 3)	TDS/Conductivity	>0.55 & <0.75	0.80
UT0023540-001 (Oct. 10)	TDS/Conductivity	>0.55 & <0.75	0.79
UT0023540-001 (Oct. 18)	TDS/Conductivity	>0.55 & <0.75	0.82
UT0023540-001 (Oct. 26)	TDS/Conductivity	>0.55 & <0.75	0.79
UT0023540-001 (Nov. 1)	TDS/Conductivity	>0.55 & <0.75	0.85
UT0023540-001 (Nov. 8)	TDS/Conductivity	>0.55 & <0.75	0.79
UT0023540-001 (Nov. 16)	TDS/Conductivity	>0.55 & <0.75	0.80
UT0023540-001 (Nov. 21)	TDS/Conductivity	>0.55 & <0.75	0.82
UT0023540-001 (Nov. 28)	TDS/Conductivity	>0.55 & <0.75	0.81
UT0023540-001 (Dec. 5)	TDS/Conductivity	>0.55 & <0.75	0.82
UT0023540-001 (Nov. 12)	TDS/Conductivity	>0.55 & <0.75	0.80
UT0023540-001 (Nov. 20)	TDS/Conductivity	>0.55 & <0.75	0.83
UT0023540-001 (Nov. 24)	TDS/Conductivity	>0.55 & <0.75	0.78

These inconsistencies do not necessarily mean that a sample is wrong, but it does indicate that something is unusual. An analysis and explanation of the inconsistencies by the Permittee would help to increase the Division's confidence in the samples. The Permittee should work with the lab to make sure that samples pass all quality checks so that the reliability of the samples does not come into question. The Permittee can learn more about these reliability checks and some of the geological and other factors that could influence them by reading Chapter 4 of *Water Quality Data: Analysis and Interpretation* by Arthur W. Hounslow. A geological influence is most likely here, since most samples have the same inconsistencies, and they recur each quarter.

The Utah Division of Water Quality (DWQ) issued the current UPDES permit on Nov. 23, 2004. It allows for a daily maximum of total dissolved solids discharged (TDS) of 1310 mg/l and a 30-day average of 500 mg/l. There is no tons per day (tpd) daily maximum, unless the 30-day average exceeds 500 mg/l; then a 7.1-tpd limit is imposed. The permit also states:

Upon determination by the Executive Secretary that the permittee is not able to meet the 500 mg/L 30-day average or the 7.1 tons per day loading limit, the permittee is required to participate in and/or fund a salinity offset project to include TDS offset credits, within six (6) months of the effective date of this permit.

The Division of Water Quality approved a Salinity Offset Plan for the Skyline Mine on January 5, 2005. A copy of the agreement can be found in the Division's Incoming files, and at:
https://fs.ogm.utah.gov/FILES/COAL/PERMITS/007/C0070005/2005/INCOMING/0006.pdf.

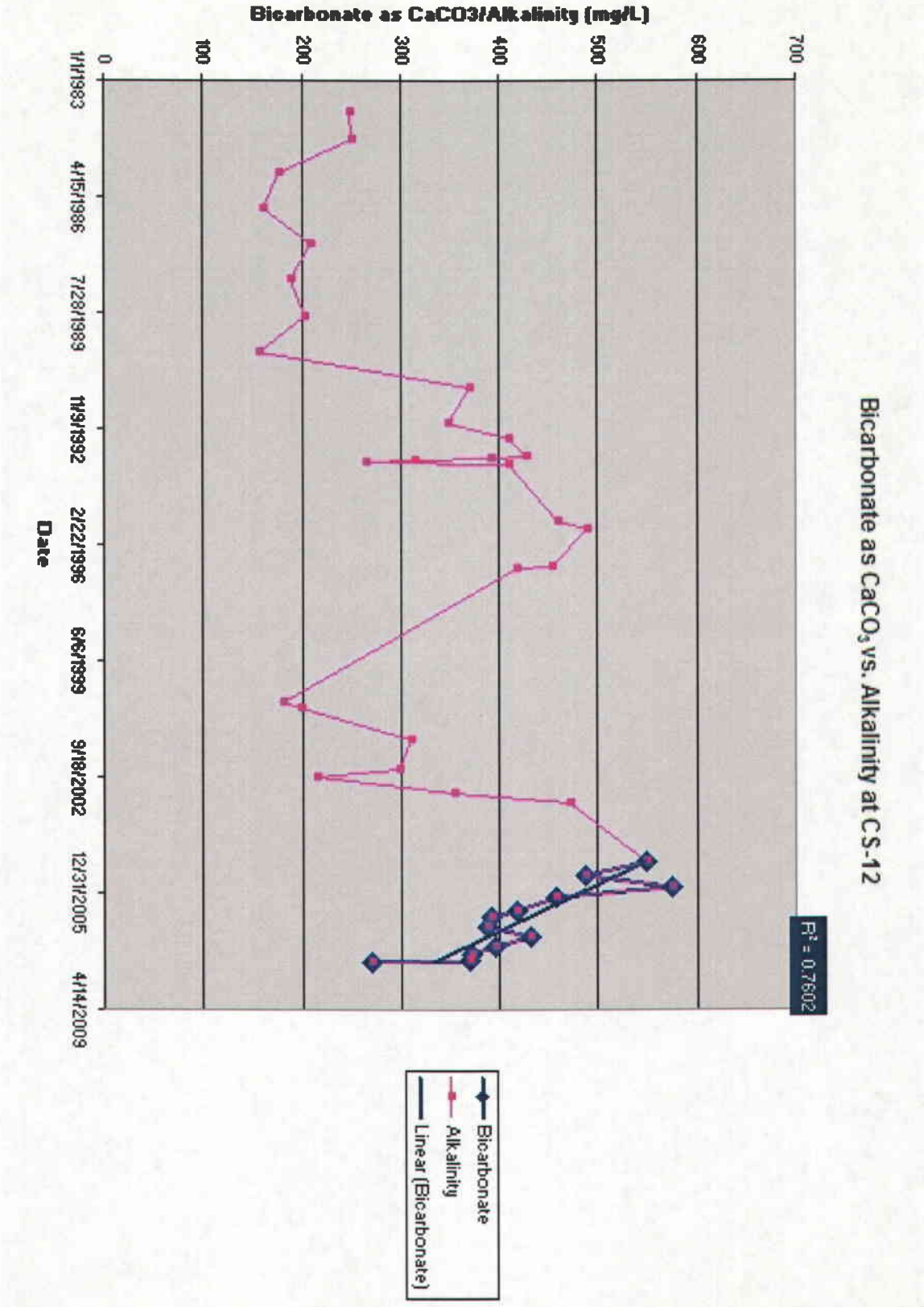
For the fourth quarter of 2007, the Permittee has not exceeded the daily max of 1310 mg/L for TDS. However, at Outfall 001 the 30-day average has remained above 500 mg/l and the tons per day were greater than 7.1, except on October 10 and 18. Because of these exceedences, Canyon Fuel Company continues to participate in the salinity-offset program.

4. On what date does the MRP require a five-year re-sampling of baseline water data.

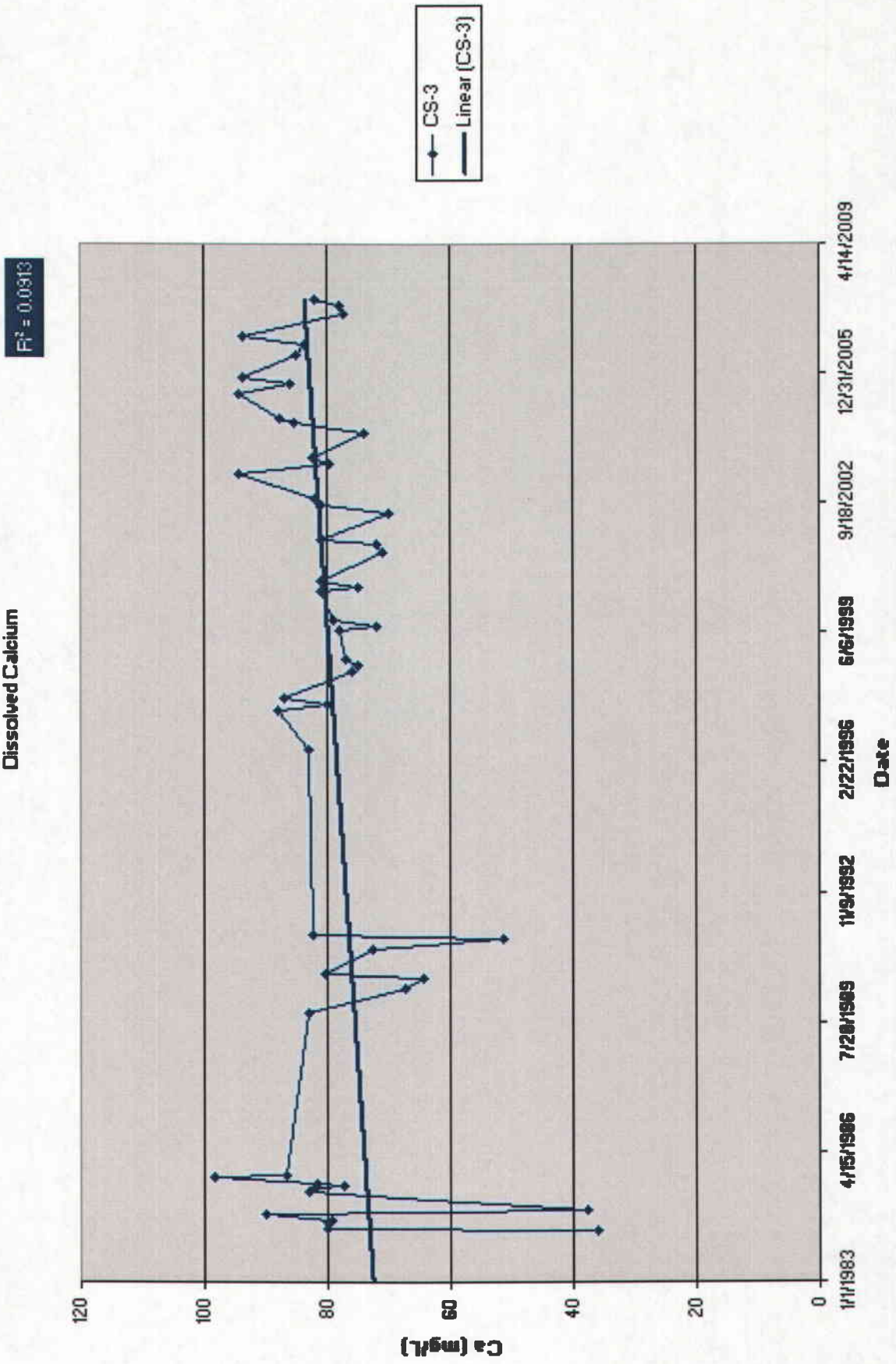
There is no commitment in the MRP to resample for baseline parameters. However, they are required to monitor 8 stream sites (CS-1, CS-7, CS-8, CS-10, CS-16, CS-17, CS-18, and VC-10) and 13 springs (S13-2, S14-4, S15-3, S22-5, S22-11, S23-4, S24-12, S26-13, S34-12, S35-8, S36-12, 2-413, and 3-290) for all operational parameters at high and low flow (where accessible) once every five years (2010, 2015, etc.), and whenever abrupt changes in flow occur.

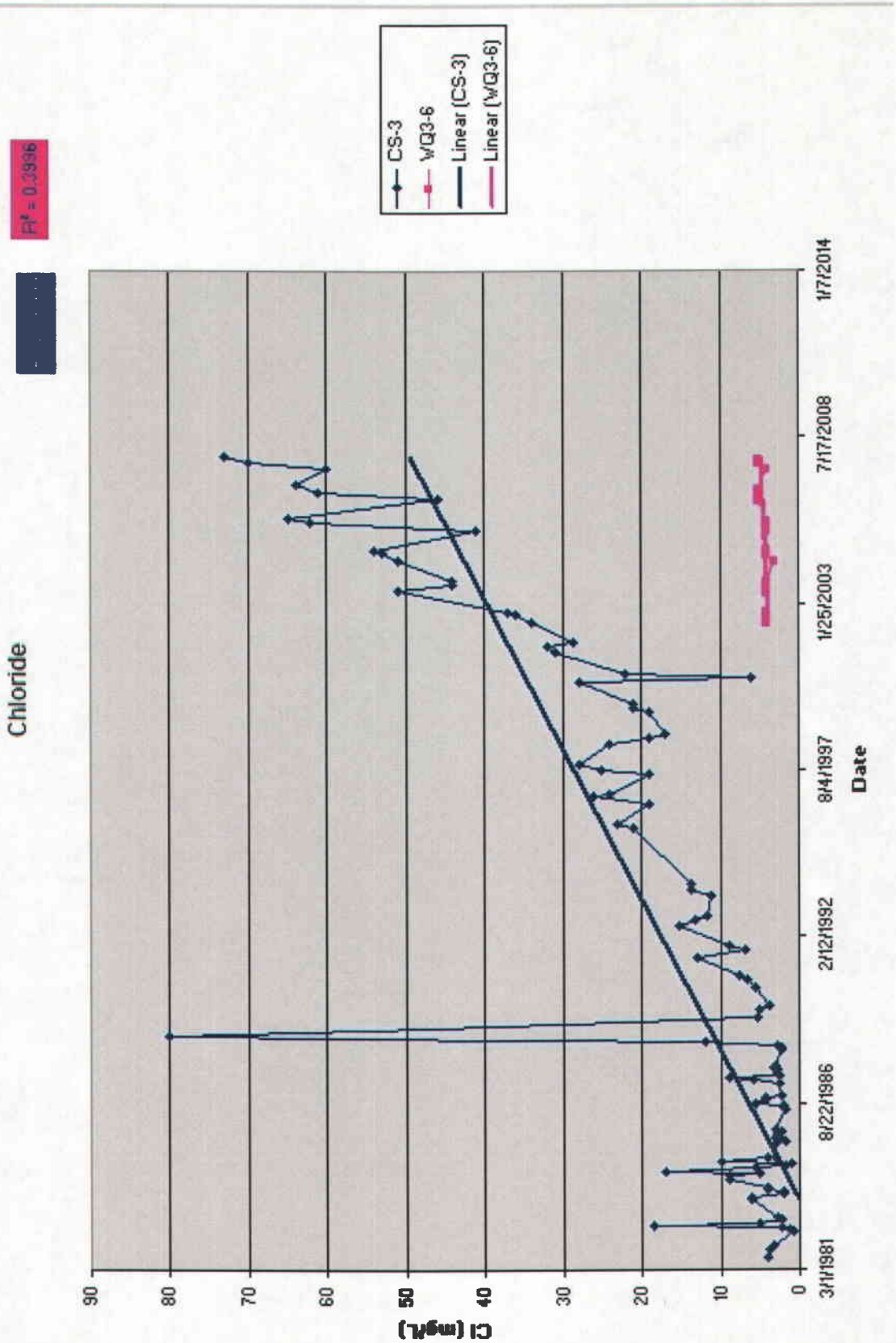
5. Based on your review, what further actions, if any, do you recommend?

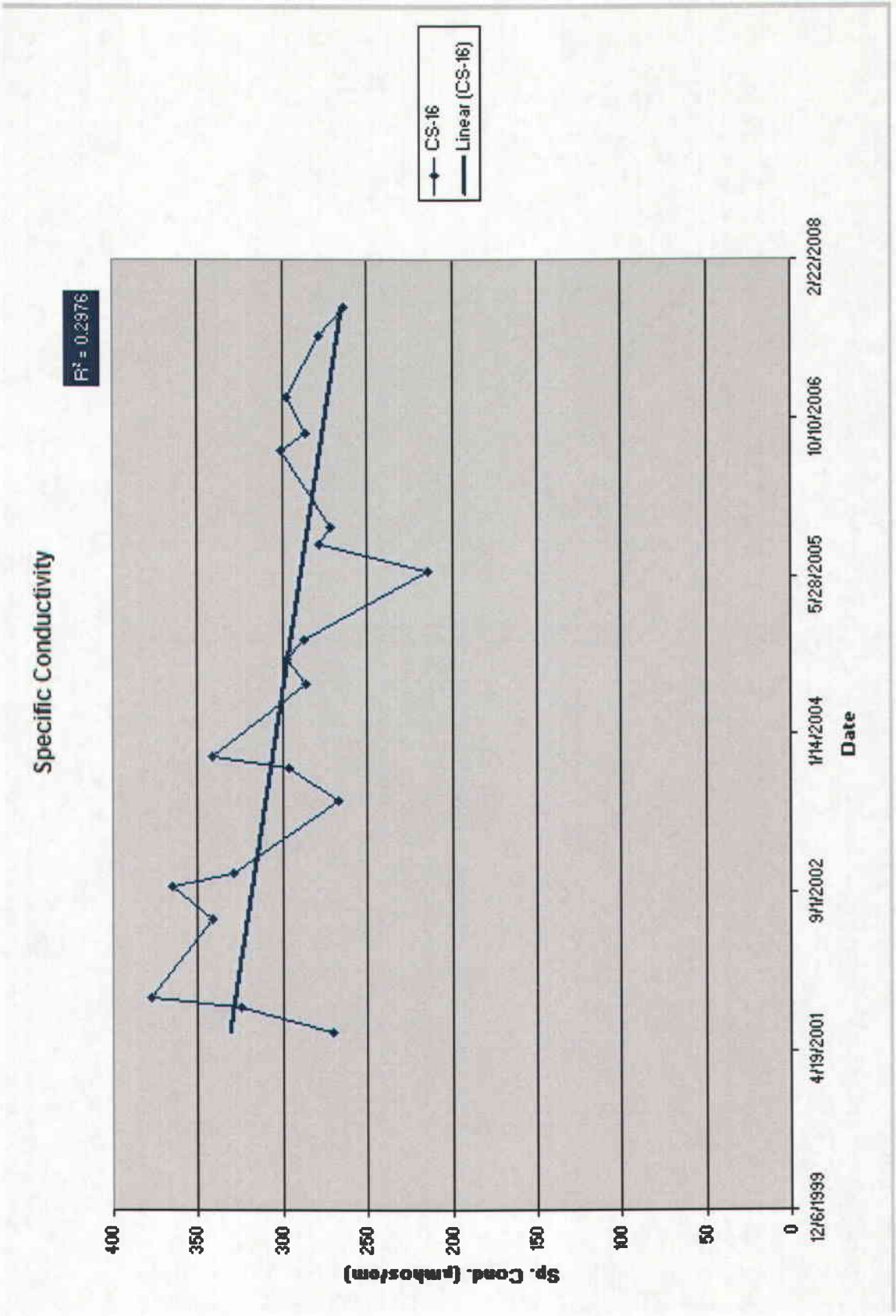
No further actions are necessary at this time.

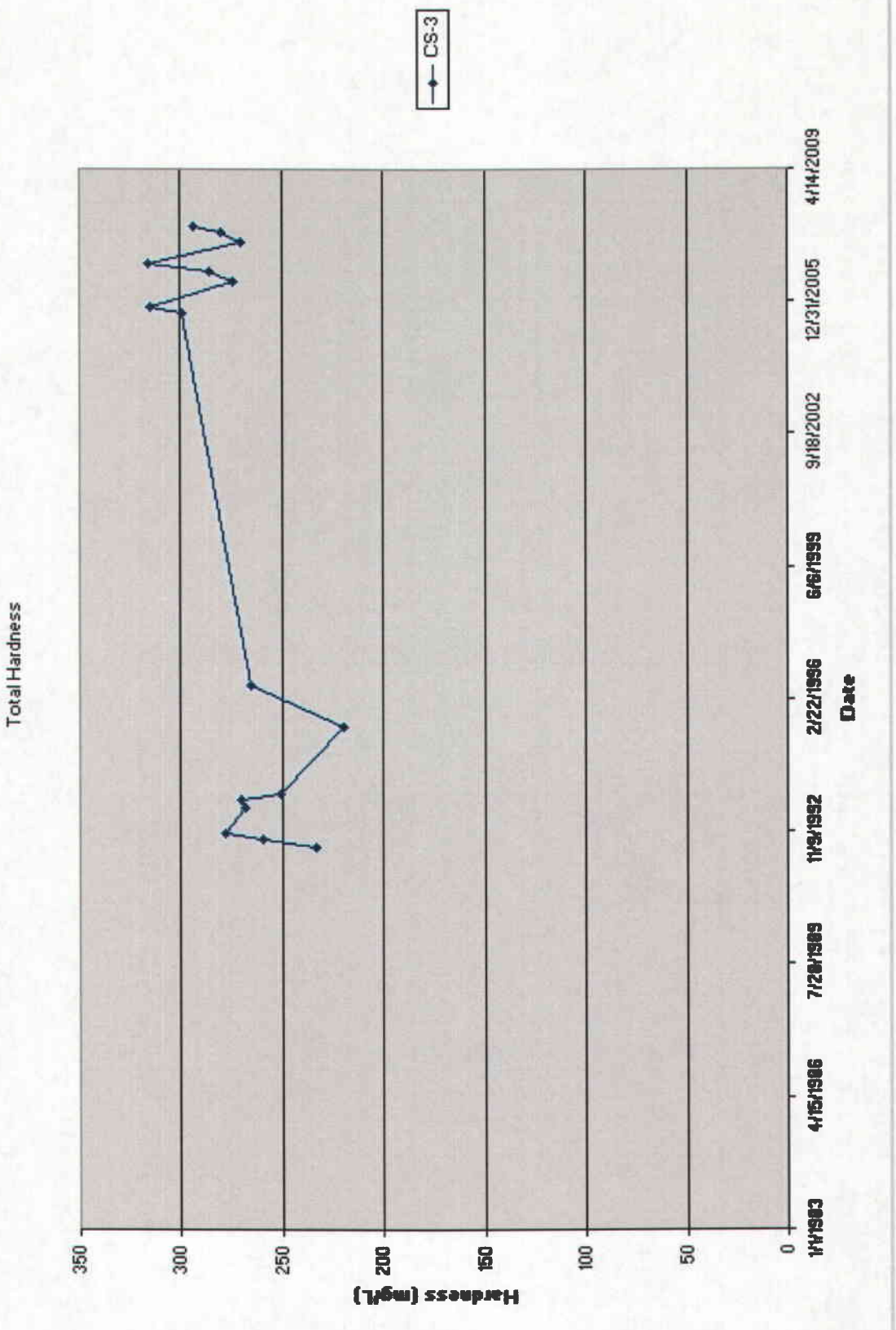


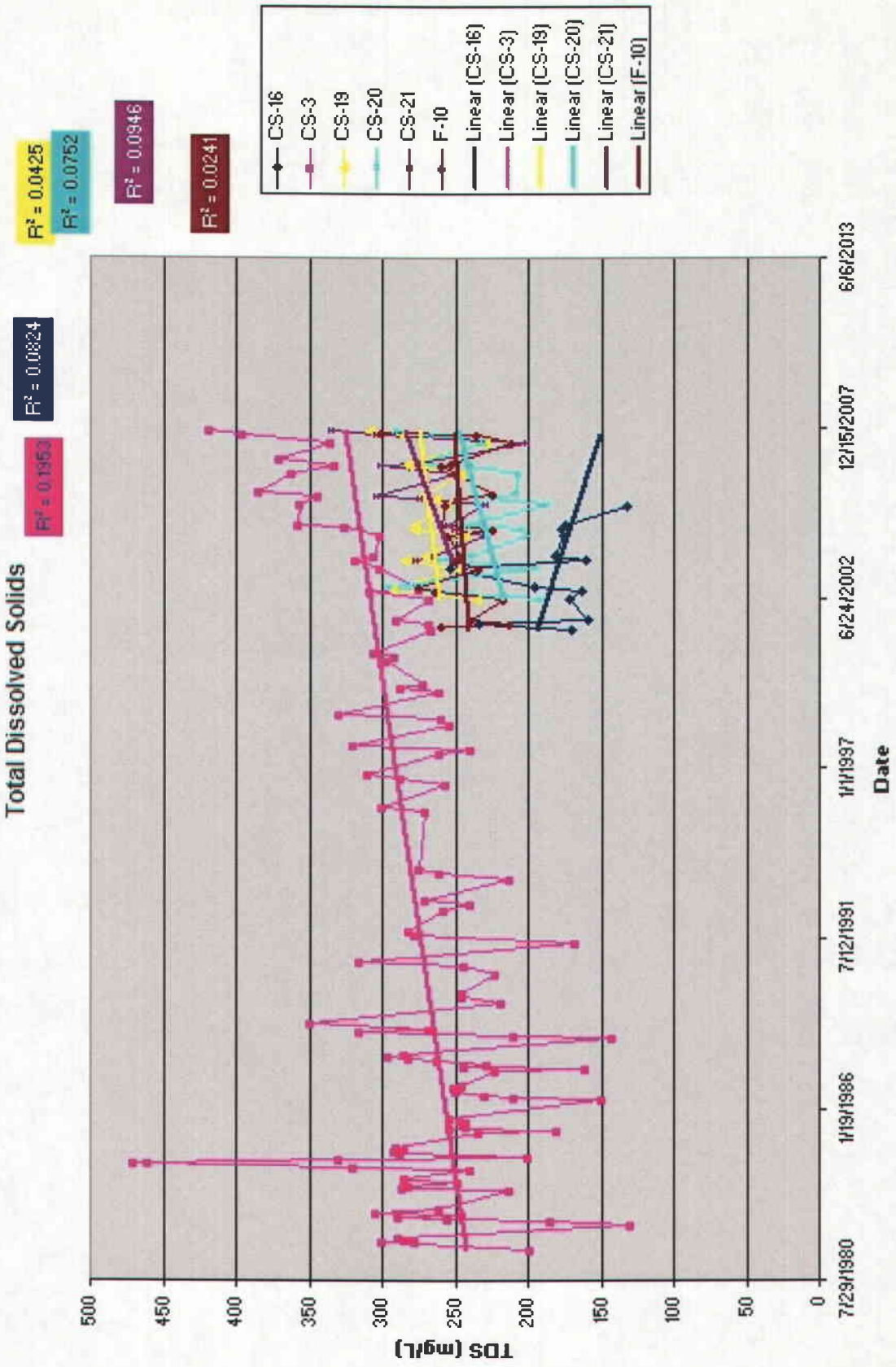
Bicarbonate as $CaCO_3$ vs. Alkalinity at CS-12

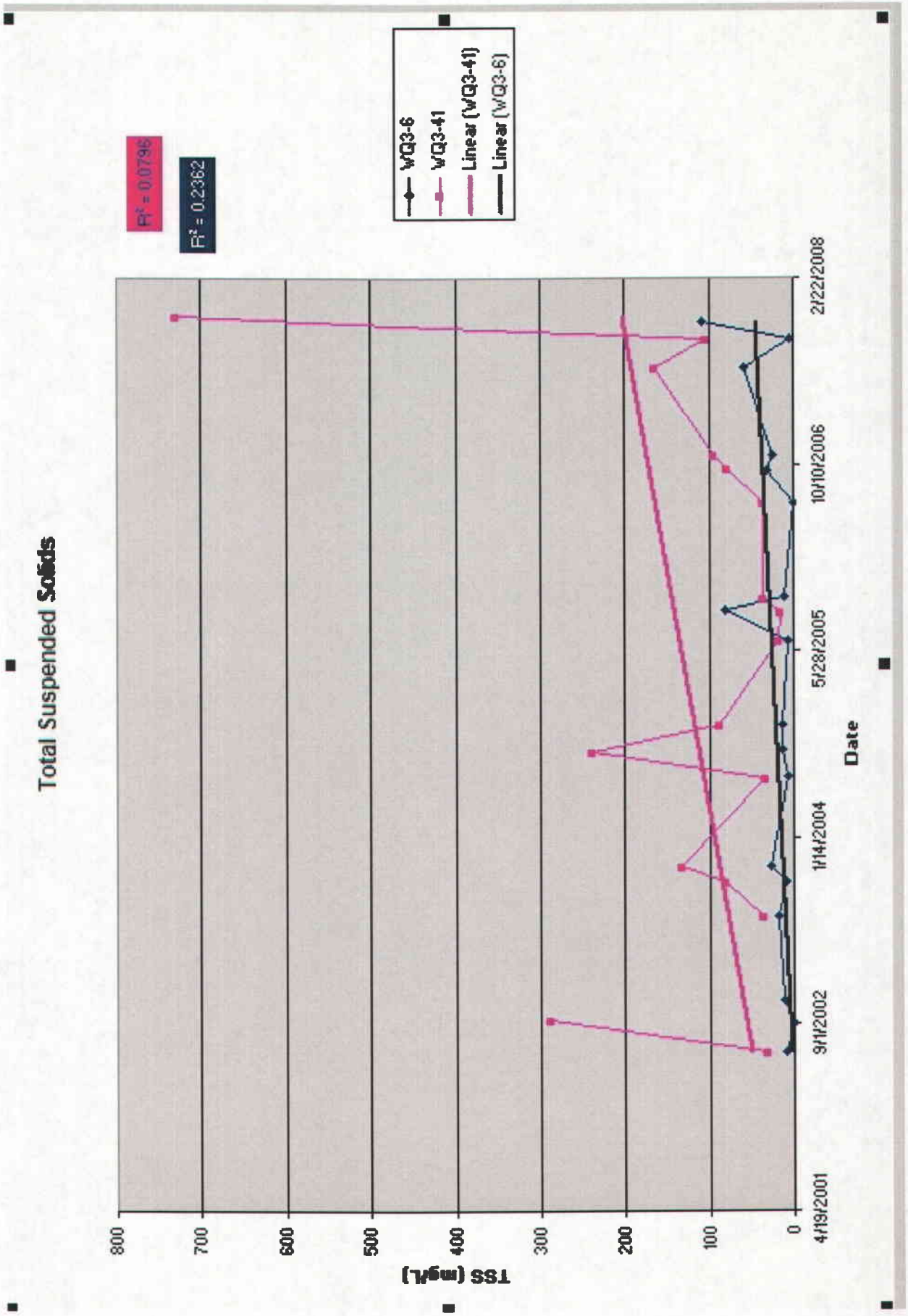

Dissolved Calcium
R² = 0.0913
CS-3
Linear (CS-3)
Ca (mg/L)
120
100
80
60
40
20
0
1/1/1983
4/15/1986
7/28/1989
11/9/1992
2/22/1996
6/6/1999
9/18/2002
12/31/2005
4/14/2009
Date


Chloride
R² = 0.3936
CS-3
WQ3-6
Linear (CS-3)
Linear (WQ3-6)
Cl (mg/L)
0
10
20
30
40
50
60
70
80
90
3/1/1981
8/22/1986
2/12/1992
8/4/1997
1/25/2003
7/17/2008
1/7/2014
Date


Specific Conductivity
R² = 0.2976
CS-16
Linear (CS-16)
Sp. Cond. (µmhos/cm)
400
350
300
250
200
150
100
50
0
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
Date


Total Hardness
CS-3
Hardness (mg/L)
350
300
250
200
150
100
50
0
1/1/1983
4/15/1986
7/29/1989
11/9/1992
2/22/1996
6/6/1999
9/18/2002
12/31/2005
4/14/2009
Date


Total Dissolved Solids
R² = 0.1953
R² = 0.0824
R² = 0.0425
R² = 0.0752
R² = 0.0946
R² = 0.0241
CS-16
CS-3
CS-19
CS-20
CS-21
F-10
Linear (CS-16)
Linear (CS-3)
Linear (CS-19)
Linear (CS-20)
Linear (CS-21)
Linear (F-10)
TDS (mg/L)
500
450
400
350
300
250
200
150
100
50
0
7/29/1980
1/19/1986
7/12/1991
1/1/1997
6/24/2002
12/15/2007
6/6/2013
Date


Total Suspended Solids
R² = 0.0796
R² = 0.2362
WQ3-6
WQ3-41
Linear (WQ3-41)
Linear (WQ3-6)
TSS (mg/L)
800
700
600
500
400
300
200
100
0
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
Date